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Fall 2014

DroughtScape- Fall 2014

Kelly Smith

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DROUGHTSCAPE

The Newsletter of the National Drought Mitigation Center

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About the photo

The photo at the top of the page, by Don DeBold, shows Sandy Wool Lake, near San Jose, California, on Aug. 31, 2014. The area is currently in exceptional drought. Reprinted under CC BY 2.0.

DIRECTOR'S REPORT



Michael J. Hayes, director of the NDMC, moderated a panel discussion on Data to Better Understand Climate Systems at the 2014 Water For Food Conference, Oct. 19-22, in Seattle.

Hello from Seattle. I am writing this column while I am attending the 6th annual Water for Food Conference. This global conference is one of the key activities of the Robert B. Daugherty Water for Food Institute, which is based at the University of Nebraska-Lincoln. The conference theme this year is "Harnessing the Data Revolution: Ensuring Water and Food Security from Field to Global Scales."

This conference has been a tremendous event. The various presentations and events have highlighted the important role data,

collaboration, and communication have in feeding the world in the future. One topic emphasized over and over again was the importance that remote sensing data and tools will play in food and water security. This includes the collection, processing, and analyzing of data from very small scales to global scale.

"... the breadth of remote sensing opportunities directly related to helping solve water, food, and drought issues is inspiring."

It is exciting to hear about all of these advancements in remote sensing technologies. The NDMC has long understood the value remote sensing tools provide for drought monitoring, and we will continue to utilize remote sensing heavily in our drought research and outreach activities. We benefit greatly in our close partnerships with UNL's Center for Advanced

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Director's column, continued from page 1

Land Management Technologies (CALMIT) and remote sensing researchers around the world.

The NDMC contributed in several ways during the conference. On the first day, the NDMC teamed with Rachael McDonnell of the International Center for Biosaline Agriculture in Dubai to help host a side event on Drought Monitoring and Early Warning Systems. The NDMC made three presentations as part of this side event, focusing on drought early warning systems (me), the U.S. Drought Monitor and the Drought Risk Atlas tools (Mark Svoboda, leader of the NDMC's Monitoring program area), and the NDMC's remote sensing tools and the related Greater Horn of Africa project (Tsegaye Tadesse, NDMC climatologist). Svoboda and Tadesse were also both featured on Day 4 of the conference, with Svoboda highlighting and providing more details on the Drought Monitor and Drought Risk Atlas in a concurrent session, while Tadesse moderated a side event on Harvesting Data from



Mark Svoboda, leader of the NDMC's Monitoring Program Area, was a panelist at the 2014 Water for Food conference.

Smallholder Farmers in Africa.

The Water for Food Conference included the signing of an MOU between the University of Nebraska and the International Water Management Institute (IWMI) located in Sri Lanka. This is particularly valuable for the NDMC because IWMI is involved in one of the initial projects supported by the

Integrated Drought Management Programme (IDMP), an initiative jointly-sponsored by WMO and the Global Water Partnership. IWMI is working to develop a drought monitoring/early warning system for Southern Asia and this MOU offers an opportunity for the NDMC to more readily assist and partner with IWMI in these efforts.

It is fulfilling when a conference like this year's DWFI Water for Food Conference provides enthusiasm and a clear path forward regarding particular activities. In this case, the breadth of remote sensing opportunities directly related to helping solve water, food, and drought issues is inspiring. I look forward to watching these innovative activities take place in the months and years ahead.

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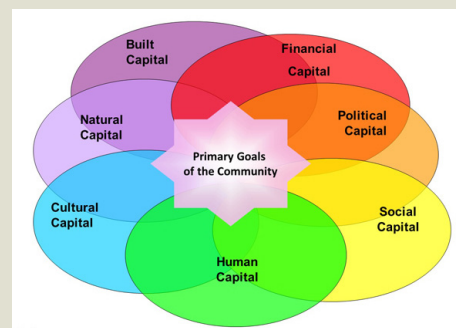
Upcoming Events

Do extreme events cause a shift in climate change beliefs? Nov. 4 Webinar

Tune in at noon Eastern time on Nov. 4 to learn about the results of a study on the 2012 Midwestern U.S. drought and agriculture, presented by Dr. Stuart Carlton, Texas Sea Grant/Texas A&M University at Galveston, brought to you by our collaborators, Useful to Usable. Learn more: <http://tinyurl.com/U2Uwebinar>

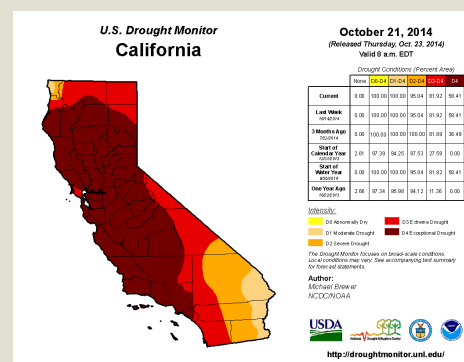
Community Capitals Framework Institute Nov. 5-7, Lincoln, Nebraska

Public health and hazard resilience will be featured at the 2014 Community Capitals Framework Institute, Nov. 5-7 at the University of Nebraska-Lincoln (UNL). Registration is ongoing at <http://go.unl.edu/ccfregistration>



Ranching and California's Drought Workshop and Webcast, Nov. 7, UC Davis

Learn about the U.S. Drought Monitor, what it means for ranchers in California, and how local experience and information can inform drought-mapping. A workshop and webinar on Friday, Nov. 7, at the University of California-Davis will answer these questions. The workshop will also focus on drought impacts on ranching and on feeding strategies to help cope with drought. Three U.S. Drought Monitor authors will explain aspects of the product: Mark Svoboda, NDMC climatologist and leader of the Monitoring Program Area, will give a behind-the-scenes look at the Drought Monitor, including history, tools and methods. Brian Fuchs, NDMC climatologist, will describe how to submit information for use in the U.S. Drought Monitor process. Brad Rippey, U.S. Department of Agriculture meteorologist, will discuss the history of the current drought in California and some of its impacts. For more information or to register, please contact Tracy Schohr at tkshohr@ucdavis.edu or (916)716-2643 or visit the workshop page: <http://bit.ly/CARanching>



Climate Masters of Nebraska Jan. 15-March 19, 2015

The next Climate Masters of Nebraska course is scheduled for Thursday evenings, Jan. 15-March 19, 2015. It will convene in Hardin Hall on UNL's East Campus from 6 to 8:30 p.m. This free, 10-week adult education (19 and over) course teaches community members about climate variability and how to reduce their carbon footprint. Topics include introduction to climate change, communicating climate change, consumption and waste, local foods, home energy and more.

Participants are asked to share the knowledge they gain with others in the community through creative volunteer work. We have many ideas for volunteer hours or participants can come up with their own projects. For more information or to register please visit <http://climatemasters.unl.edu/Home.aspx>



Second-quarter drought and climate summary

By Brian Fuchs, Climatologist,
National Drought Mitigation Center

Drought classifications are based on the U.S. Drought Monitor. Details on the extent and severity of drought are online at <http://droughtmonitor.unl.edu/archive.html>. The outlook integrates existing conditions with forecasts from the National Oceanic and Atmospheric Administration's Climate Prediction Center: <http://www.cpc.ncep.noaa.gov/>

Drought Summary

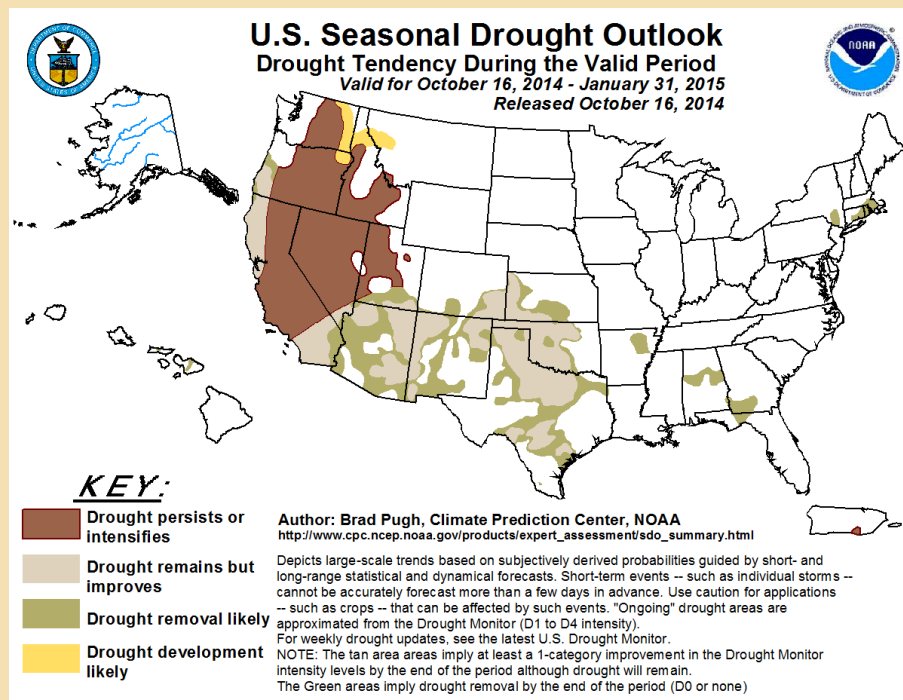
Drought in the western United States intensified in July, August and September. By the end of September, more than 58 percent of California was in exceptional drought (D4), representing an area that is home to more than 27 million people, and the entire population of the state, more than 37 million people, was in moderate drought or worse. For the contiguous 48 states, drought improved during the quarter, with 30.57 percent of the surface area in drought at the end of September compared to 34.01 percent of the country at the beginning of July. Severe drought improved from 25.00 to 18.66 percent, extreme drought improved from 11.98 to

9.41 percent, and exceptional drought worsened from 2.98 to 3.85 percent. At the end of September, more than 76 million people were in areas designated as being in moderate drought or worse, an increase from the 72 million at the beginning of July. This is because drought emerged in densely populated areas of the Northeast, even though the total area decreased.

Precipitation

Many areas of the United States recorded above-normal precipitation from July through September, including much of the interior West, from Arizona to Montana. Some areas most affected by the seasonal monsoon rains in the Southwest recorded up to 10 inches more than normal rain during the quarter. Precipitation was mixed on the Plains, as some areas of West Texas, Nebraska and the western Dakotas received more than normal, while most of Kansas, Oklahoma, central Texas and the eastern Dakotas were below normal. Most areas from eastern Nebraska through Iowa and into Illinois and Indiana received significant rains during the quarter, with much of western Iowa up to 10 inches above normal. The Southeast and Gulf Coast had a dry pattern, with the Florida Panhandle and central Alabama up to 10 inches below normal. South Florida was wetter, with most areas receiving 5-10 inches more than normal rain. The Mid-Atlantic and New England states were mixed, with some significant deficits in northern New Jersey, southeast New York, Long Island and Connecticut, where rainfall for the quarter was 5-10 inches below normal.

Outlook



The seasonal drought outlook that goes through the end of January 2015 is showing that many areas of the South, Southeast, and Southwest are likely to see drought conditions improve and/or be eliminated completely. For most of California, Nevada, Oregon, Washington, Idaho, and Utah, the drought is expected to persist, but may ease in some areas. Drought could develop further in eastern Washington, northeast Oregon, northern Idaho and western Montana.

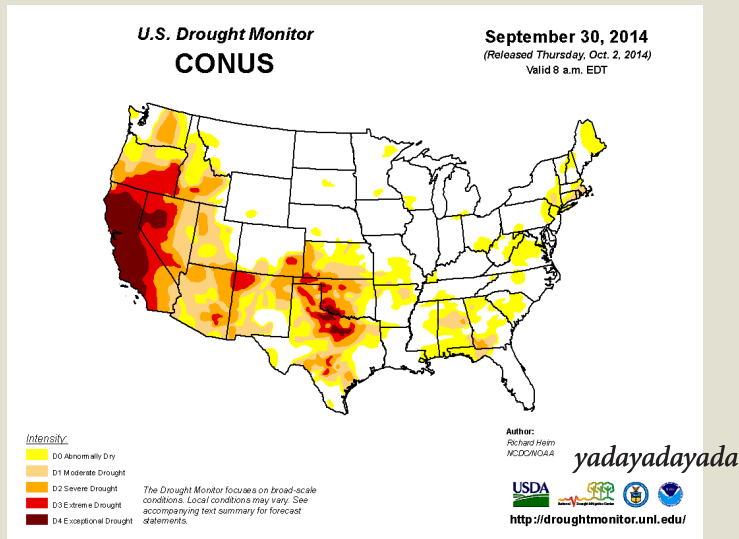
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Temperatures

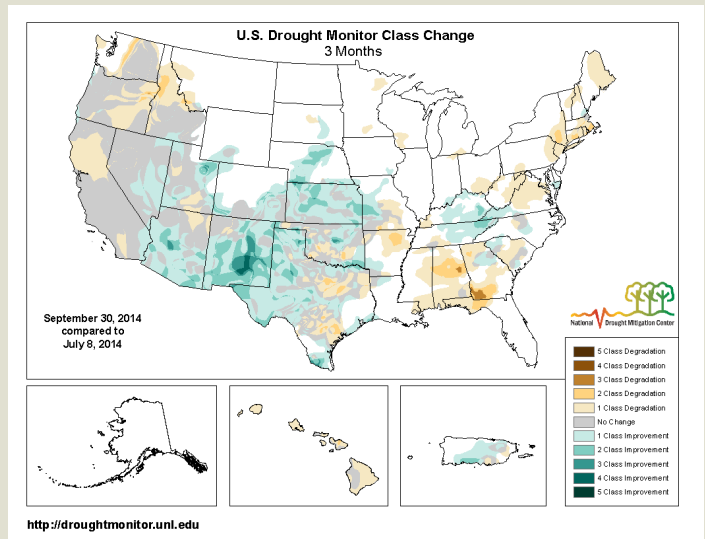
Cool summer temperatures extended into early autumn. Almost all areas east of the Continental Divide recorded below-normal temperatures for the quarter, with only central and south Texas and areas along the Gulf Coast in the Southeast being warmer than

usual. The places with the coolest readings were also the wettest, with Iowa, Illinois, Indiana and Nebraska 2-4 degrees Fahrenheit below normal for the quarter. Areas in the West, especially in the Great Basin and along the West Coast, continued to be warmer than normal. Areas in Washington,

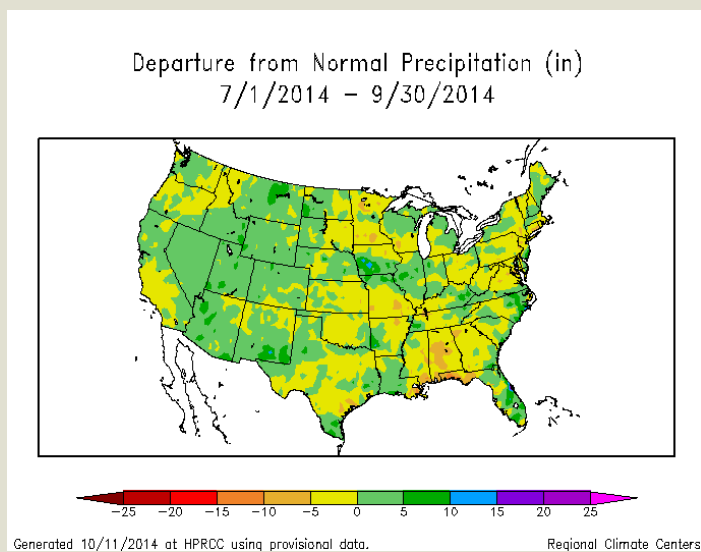
western Idaho, Nevada and California were up to 6 degrees above normal for the quarter, with the warmest readings in western and eastern Oregon. The parts of Arizona, southern California and Nevada that had the most rain were also as much as 6 degrees cooler than normal.



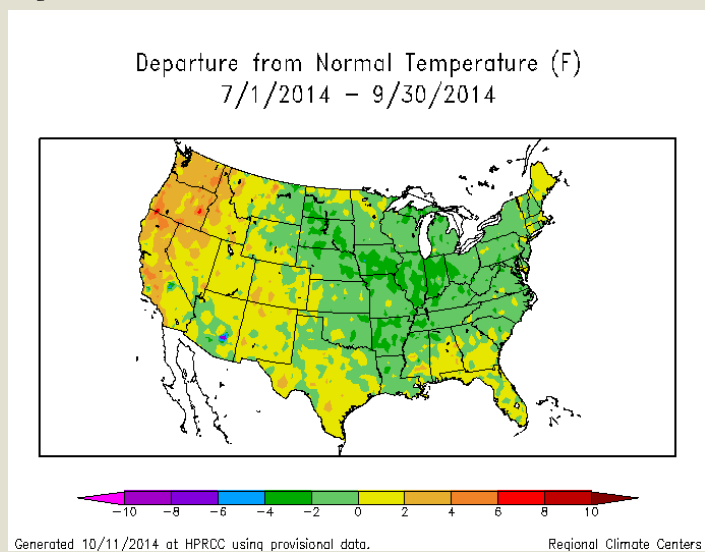
By Sept. 30, the area in drought was down to 30.57 percent of the contiguous 48 states, affecting more than 76 million people.



This map shows areas where drought intensified or improved in the third quarter of 2014. New Mexico saw the greatest improvements.



Much of the western United States was wetter than normal from July through September 2014. The Gulf Coast and areas to the north were dry.



The Pacific Northwest led the country in being warmer than usual, though much of the West and Southeast was also warm. The Plains, Midwest, Mid-Atlantic and Northeastern states, except for Maine, were on the cool side.

Third quarter impacts concentrated in West

By Denise Gutzmer, Drought Impact Specialist, NDMC

As drought wore into its third year in some parts of the West, especially California, impacts intensified. This summer, crop planting was cut back, municipal water supplies dwindled, job opportunities shrank and wildlife worked harder to find food. Drought eased in the southern Great Plains, but there, too, water supplies were down from years of drought. Most drought impacts for the third quarter of 2014 were for California and Texas, with 211 and 66, respectively, and 375 impacts in all for the nation.

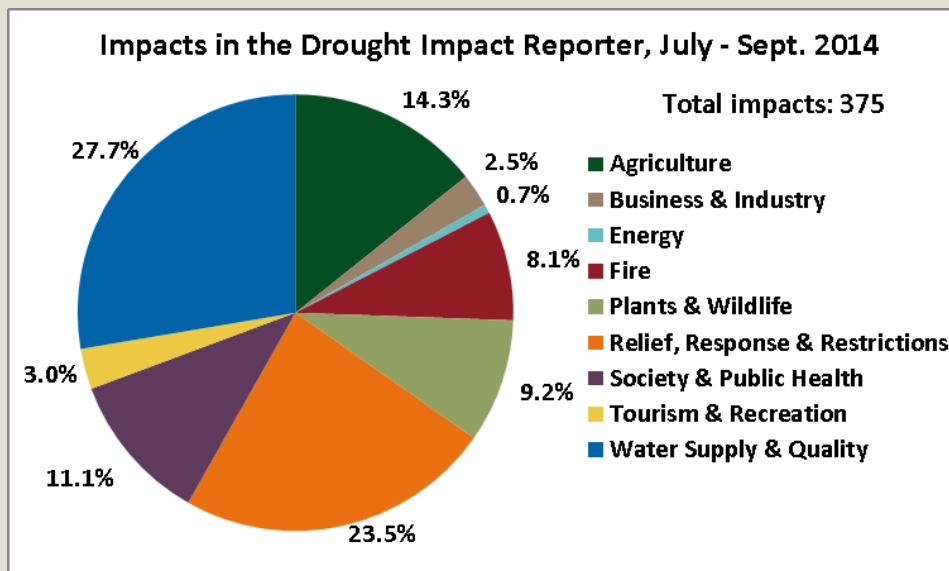
Drought in Western U.S. affecting Earth's surface

Earth's surface rising in Western U.S.: Drought cost the Western U.S. about 63 trillion gallons of water over the past year and a half, say researchers from UC San Diego's Scripps Institution of Oceanography and the U.S. Geological Survey. The Earth's surface rose about 0.16 inches during that time. In the Sierra Nevada and the Coast ranges in California, the water loss was even greater as the surface rose as much as 0.6 inches.

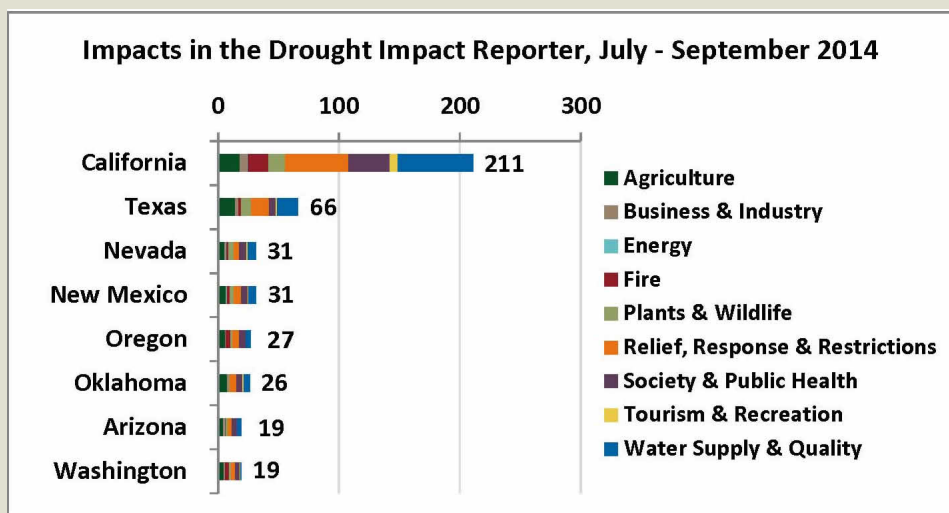
"63 trillion gallons of groundwater lost in drought, study finds," by Rong-Gong Lin II, Los Angeles Times, Aug. 21, 2014

Drought, heat lead to mudslide on Mt. Shasta: An immense mudslide in Mud Creek Canyon on Mt. Shasta has been attributed to drought and heat after debris and mud flowed down the mountain on Sept. 20. Experts think that glacial melting could have produced water which destabilized huge ice blocks and caused the debris flow in the Shasta-Trinity National Forest.

"Forest Service thinks California's drought caused a massive mudslide," by Tony Barboza, Los Angeles Times, Sept. 22, 2014.



This pie chart shows that of the 375 impacts in the Drought Impact Reporter for July-September, more than a quarter related to water supply, and the next largest category dealt with official responses to drought.



This bar chart shows impacts by state, colored by category, for the eight most-affected states.

Colorado River Basin

Water losses in the Colorado River Basin: The Colorado River Basin lost nearly 53 million acre-feet between December 2004 and November 2013, with 75 percent of that loss coming from underground sources, said researchers from NASA and University of California, Irvine. Data from the NASA Gravity Recovery and Climate Experiment mission were used to calculate

changes to the basin's mass.

"Groundwater loss in the Southwest called 'shocking,'" Associated Press, Las Vegas Sun, July 24, 2014

Falling level of Lake Mead provoking anxiety in Southwest, but larger water allocation coming in 2015: Major cities and other water users in the Southwest grew increasingly anxious as Lake Mead declined to the lowest it has been since the lake was filled in

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the 1930s. The lake hit a new low of 1,080 feet above sea level, 145 feet lower than the record high of 1,225 feet in 1983. Lake Mead will receive a larger allocation of 8.23 million acre-feet from Lake Powell in 2015, thanks to plentiful snowfall in the Rocky Mountains.

"As Southwestern drought hangs on, Lake Mead in critical condition," by Ken Ritter, Associated Press, Aug. 12, 2014

"More water headed to struggling Lake Mead," by Conor Shine, *Las Vegas Sun*, Aug. 13, 2014

California responses to drought

Regulation of groundwater pumping: Gov. Jerry Brown of California signed a package of regulations instituting the management of groundwater pumping, which has been regulated in most Western states. The ongoing drought brought extensive pumping of groundwater, land subsidence and other water issues that helped build the political will to develop and pass

such legislation.

"Governor signs first California groundwater rules," by Fenit Nirappil, Associated Press, Sept. 16, 2014

California homeowners cannot be fined by HOAs for having brown lawns, xeriscaping: Gov. Jerry Brown signed AB2100 into law on July 21, protecting homeowners who allow their lawns to turn brown during drought. AB2104, signed by Gov. Brown on Sept. 18, allows homeowners to landscape with drought-tolerant plants, regardless of homeowners association guidelines prohibiting the practice.

"Law blocks some brown lawn fees during droughts," Associated Press, July 21, 2014

"HOAs barred from requiring lush landscaping," Associated Press, Sept. 19, 2014

Greater need for food assistance at California food banks: California's business, agriculture, and civic organizations have joined forces with the California Community Food Bank to form the "California Water Feeds our Communities" food drive

to collect and distribute food to food banks across the state. The historic drought has increased demand but limited donations at food banks.

"California business, farm and community groups join forces for drought relief in statewide food giveaway," PRWeb (Chicago), Aug. 19, 2014

California water supplies

End of California 2014 water year: The 2014 water year (Oct. 1-Sept. 30) was one of the driest on record, with California receiving less than 60 percent of average precipitation. Collectively, major reservoirs in the state held only 57 percent of average storage as of Sept. 1.

"Dry water year 2014 ends tomorrow," California Department of Water Resources, Sept. 29, 2014

Metropolitan Water District of Southern California water supplies down more than two-thirds: The Metropolitan Water District of Southern California has used slightly more than two-thirds of its stored supplies during the past three years, leaving about 18 months' worth of water remaining.

"California water wholesaler supply drastically drained," CBS News, Sept. 22

Agriculture

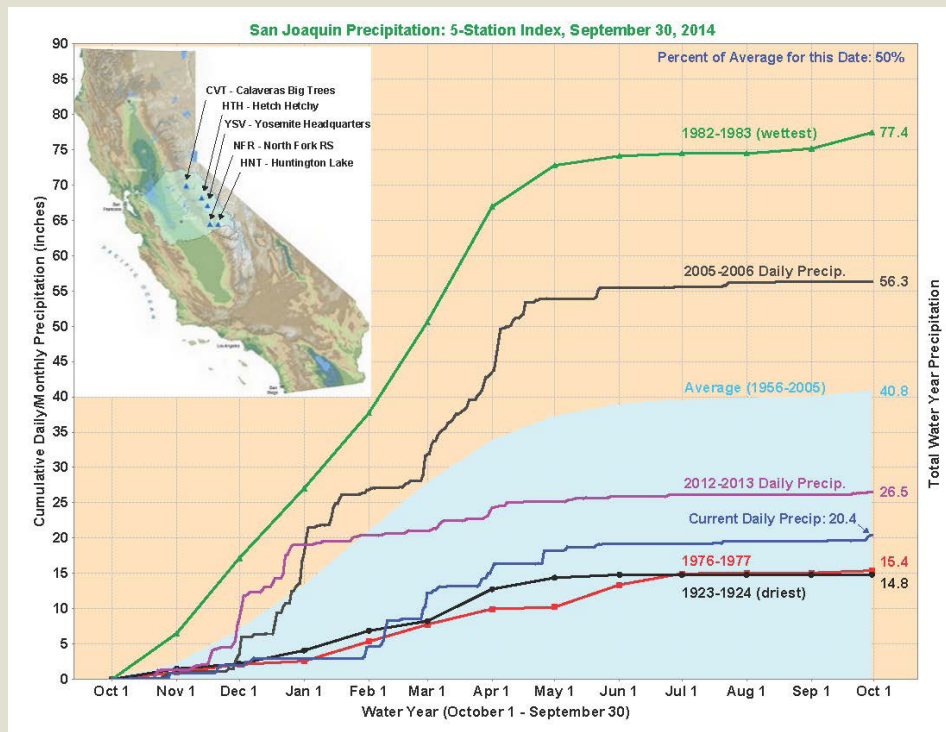
California crop production down, hay prices up: Rice, grapes, oranges, hay, corn, pistachios and almond production fell in California during the state's third year of drought because there was less water for irrigation. Oat, barley and wheat pastures were parched, driving hay prices to record highs.

"California's drought sends hay prices soaring," by Martin Espinoza, *The Press Democrat* (Santa Rosa, Calif.), Sept. 2, 2014

"California harvest much smaller than normal across crops," by Dale Kasler, *The Sacramento Bee* (Calif.), Sept. 28, 2014

Drought cuts California honey production: Drought has cut California's honey production

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The San Joaquin Precipitation 5-Station Index for Sept. 30, 2014, shows that the 2013-14 water year was slightly wetter than the driest years on record, 1923-24 and 1976-77. Chart from the California Department of Water Resources.

California Agriculture, 2014 v. 2013 in acres, unless otherwise noted			
Parameter	2014	2013	Drop
Total Field Crops Planted	3,580,000	4,009,000	10.7%
Wheat Harvested	215,000	394,000	45.4%
Barley Harvested	25,000	42,000	40.5%
Corn Harvested	110,000	180,000	38.9%
Oats Harvested	10,000	15,000	33.3%
Sunflower Harvested	42,400	58,000	26.9%
Rice Harvested	428,000	561,000	23.7%
Cotton Harvested	213,000	278,000	23.4%
Mushrooms (Agaricus), ft ² filled	17,884,000	22,431,000	20.3%
Mushrooms (Agaricus), ft ² in prod.	2,986,000	3,626,000	17.7%
In addition, harvested acres of asparagus, dry edible beans, hay, dry summer onions, and spring potatoes were each down 2.7% to 5.7%. Acres bearing oranges were down 3.4%. Harvested acres of safflower, strawberries, sugar beets, and sweet potatoes were unchanged or up slightly.			
Table compiled by Rich Tinker, NOAA Climate Prediction Center, using data from the U.S. Department of Agriculture's National Agricultural Statistics Service.			

by more than half, compared to annual averages before the drought. In 2010, 27.5 million pounds of honey were produced in the state, and in 2013, the honey crop was 10.9 million pounds. The 2014 honey crop was expected to be even lower than last year as drought dried up native plants and wildflowers.

"California drought stings bees, honey supplies," Terence Chea, Associated Press, Aug. 21, 2014

Washington, Idaho wheat crop: The wheat crop in the Inland Northwest was about 30 percent lower than last year's yield and a little below the 10-year average. Wheat was planted deeper in dry areas in the fall of 2013, and significant rainfall caused the soil to form a crust that the wheat plants could not break through. Some farmers replanted two or three times. The dry spring and summer and 100-degree

temperatures sealed the crop's fate.

"Dry, warm weather taking toll on wheat crops," by Daniel Moore, *The Spokane Spokesman-Review* (Wash.), Aug. 19, 2014

Wildfire

Active fire season strains California budget: The fire season in California has been very active. The California Department of Forestry and Fire Protection has fought 5,000 fires, roughly 1,200 more fires than normal for this time of year. The King Fire in El Dorado and Placer counties burned more than 100,000 acres, while the Boles Fire in Siskiyou County charred 143 homes. The expense of fighting California's many wildfires has used the \$209 million set aside for the task less than three months into the new fiscal year. In addition, the extra money spent on firefighting contributed to the governor's veto of legislation giving \$50 million

each to the University of California and California State University systems.

"Bay Area braces for heat wave; fire crews wary," by Rick Hurd, *Contra Costa Times* (Calif.), Oct. 1, 2014

"Wildfires prove costly for California budget," by Chris Megerian, *Los Angeles Times*, Sept. 29, 2014

"Brown vetoes \$100 million boost for UC, Cal State," Associated Press, Sept. 28, 2014

Oregon, Washington wildfires nearly three times average acres burned: Oregon and Washington endured 3,270 wildfires that burned 1,284,013 acres of federal, state and private land from the start of 2014 through Sept. 22. The number of fires was lower than the 10-year average, but the spatial extent of the fires was nearly three times the 10-year average of 452,039 acres. Total firefighting costs have risen to \$446 million, in comparison with \$235 million at this time last year.

"Pacific Northwest wildfire season: Oregon and Washington topped nation in acres burned," by Mark Friesen, *OregonLive.com* (Portland), Sept. 24, 2014

Wildlife

Judge affirms water flows for salmon: Siding with salmon, a federal judge in Fresno denied the temporary injunction sought by Westlands Water District and the San Luis & Delta-Mendota Water Authority. The two water agencies wanted water releases from a reservoir on the Trinity River to end because less water will be left for

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For more information on these and many more impacts, please visit the Drought Impact Reporter, <http://droughtreporter.unl.edu>

Submit a report about drought's effects: <http://public.droughtreporter.unl.edu/submitreport/>

Central Valley farmers next year. The U.S. Bureau of Reclamation increased flows into the Trinity River in 2013 and 2014 to lessen the spread of disease among salmon and to aid the fish in their journey upstream. A massive fish kill occurred in 2002 due to low water conditions.

"Judge upholds water for Klamath fish," Associated Press, Oct. 2, 2014

Dry bird habitat revived in Central Valley: The Nature Conservancy of California developed a new rescue program to make bird habitat available during drought by offering money to farmers to flood their rice fields early with well water and keep the fields inundated into April 2015. Many historic wetlands in the Central Valley and three refuges in the Sacramento National Wildlife Refuge Complex were parched amid ongoing drought.

"Pop-up' wetlands give birds a rest," by Ellen Knickmeyer, Associated Press, Sept. 14, 2014

Energy

Hydropower production down in California: Drought reduced hydropower production in California in the first half of 2014. Whereas hydropower normally makes up about 20 percent of the state's energy production, it only comprised 10 percent during the first half of 2014. Natural gas, wind and solar made up the difference. Drought curbed California hydropower production by 1,628 megawatts, according to the California Independent System Operator Corporation.

"California drought prompts increase in natural gas," by Laura Barron-Lopez, The Hill (Washington, D.C.), Oct. 6, 2014

"California ISO: Challenging 2014 summer but reliability held firm," via Reuters, Oct. 20, 2014, press release from the California Independent System Operator Corporation

Lake Tahoe falls below natural rim; hydropower production stopped in Nevada: Lake Tahoe fell to the point that

water no longer flowed out of the lake to feed the Truckee River. The lake has contributed little to the river in recent months. The Truckee Meadows Water Authority asked its water customers to lower their water use by 10 percent, as drought sapped area reservoirs that previously fed the Truckee River. Hydropower production at three plants ended at the end of July.

"Drought: Tahoe will dip below its natural rim this month," by Jeff DeLong, *Reno Gazette-Journal* (Nev.), Sept. 28, 2014

"Drought shuts hydro power generation," by Colin Lygren, KOLO-TV ABC 8 (Reno, Nev.), July 30, 2014

Texas

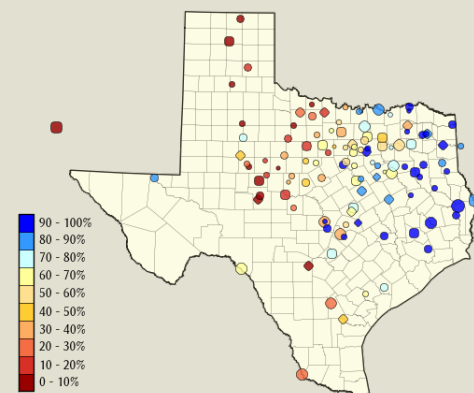
Despite rainfall in parts of Texas, many reservoirs remained dangerously low, forcing communities to limit water use until rain replenishes water supplies.

Stage 4 water restrictions for the Guadalupe-Blanco River Authority in Texas: The Guadalupe-Blanco River Authority entered stage 4 water restrictions because the average 24-hour spring flow rate from Comal Springs was 94 cubic feet per second, below the trigger of 100 cubic feet per second. Stage 4 brings tighter limits on landscape watering, pool filling and vehicle washing.

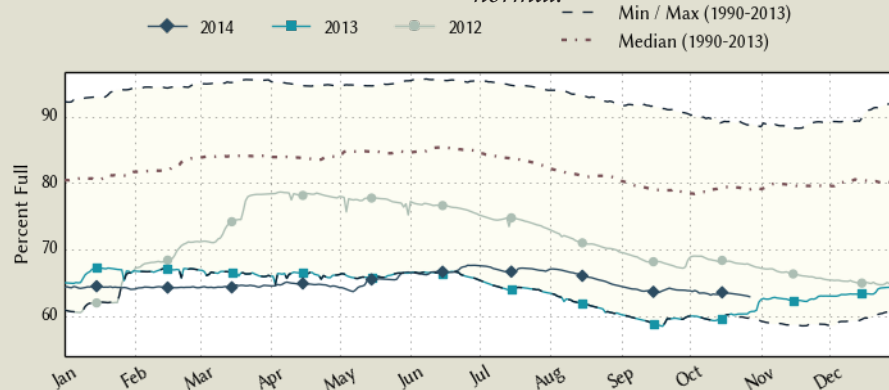
"GBRA moves to Stage IV restrictions on lakes," *New Braunfels Herald-Zeitung* (Texas), Aug. 11, 2014

Flow of the San Marcos Springs fell to 120 cubic feet per second, halting work near the springs: The flow of the San Marcos Springs fell to 120 cubic feet per second, halting work on projects near the springs to make sure that no damage was being done to endangered species or their habitats. Projects on hold include Texas Wild Rice restoration and protection through the State Scientific Areas in San Marcos; a sediment removal program to protect habitats from being covered by erosion materials; and vegetation restoration efforts to remove non-native plants and replace them with native species.

"Drought prompts San Marcos to enact 'Provision M' habitat plan," *Austin American-Statesman* (Texas), Aug. 14, 2014.



This map from *Water Data for Texas* shows that as of Oct. 27, 2014, most reservoirs outside East Texas were below normal.



Monitored water supply reservoirs in Texas were 62.9% full as of Oct. 27, 2014, below the 1990-2013 median 79 percent for this time of year, according to *Water Data for Texas*.

NDMC helps Brazil implement drought early warning and risk management

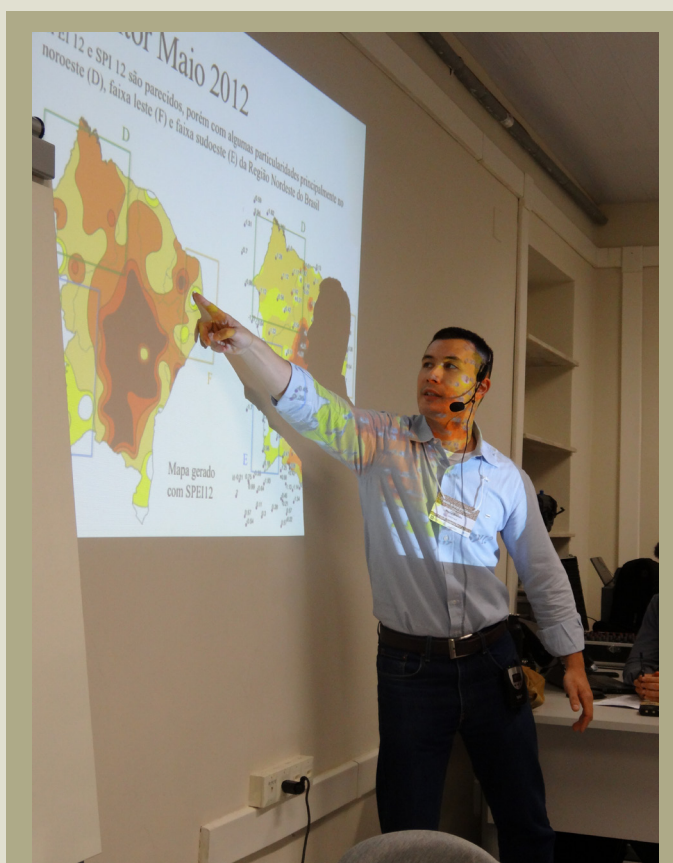
Efforts to help Brazil be better prepared for drought are underway at a variety of scales, and experts associated with the National Drought Mitigation Center at the University of Nebraska-Lincoln have been involved in several of them.

Mike Hayes, climatologist and director of the NDMC, spent an intensive two days in the state of Pernambuco in August as a visiting expert. His host was Sebrae, an organization similar to the United States' Small Business Administration that is working to expand the employment opportunities available in rural areas and among small entrepreneurs. Droughts have a tremendous impact on these groups and one of the objectives is to reduce the number of people displaced to urban areas during drought.

Mark Svoboda, climatologist and leader of the NDMC's Monitoring program area, was in Ceara in August as part of an ongoing World Bank project to establish an

operational drought monitoring product for northeast Brazil.

Sebrae has convened a multi-sector group whose name translates as the Permanent Forum for Drought Initiatives in Pernambuco, located in Brazil's arid northeast. Hayes said he was very encouraged by the broad group of stakeholders coming together in the Forum to learn about and plan for drought, and by the fact that some of the participants were also involved in the parallel World Bank effort, adding, "For me, it's extremely important to bring



Bruno Biazeto helps fine-tune the new Brazilian drought monitoring process.

multiple efforts together."

On the first day of his visit, Hayes provided a detailed description of the NDMC and its activities for a technical audience. The next day, he gave two talks on drought planning, one to the Permanent Forum for Drought Initiatives, and another to a more general audience that included academics, officials, and the general public.

Hayes' trip came about in part through UNL's activities as a host for the Brazilian Scientific Mobility program, which hosts Brazilian students and fosters exchange of scientific researchers. UNL had also hosted a visit from Sebrae in 2013.

A major focus of the World Bank project has been



Geraldo Eugenio, left, organized the trip by Mike Hayes, right, director of the NDMC. Eugenio is the technical director for the Technological Institute of Pernambuco and the technical coordinator for the Permanent Forum for Drought Initiatives.

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establishing drought monitoring and early warning for nine states in northeast Brazil. Svoboda, NDMC climatologist Brian Fuchs, and NDMC geospatial analyst Chris Poulsen have been working with their Brazilian counterparts since January to develop a drought monitoring process and product similar to the U.S. Drought Monitor. Brazilian scientists visited Lincoln, Nebraska, in March to learn more about how a U.S. team assembles the U.S. Drought Monitor map each week. In August, Svoboda traveled to Fortaleza, capital of Ceara, a state in northeastern Brazil, where he served as a consultant for a week-long, hands-on World Bank training. About two dozen scientists came together to focus on assimilating many different kinds of data into a single map. The Brazilian team plans to have an operational drought monitoring product in place by early 2015.

In May, Don Wilhite, a drought expert who founded the NDMC and served as its director until 2006, gave the keynote talk at a workshop on national drought policy in Fortaleza, Brazil, sponsored by the World Bank, Brazil's National Ministry of Integration, and the Centro de Gestao e Estudo Estrategicos (Center for Strategic Studies).

Much of the Brazilian activity has been the direct or indirect result of the High Level Meeting on National Drought Policy, held in Geneva, Switzerland, in March 2013. One of a series of regional follow-up workshops was in Brazil in December 2013.



Mark Svoboda, center, works with a small group on assimilating drought data.

"... it's extremely important to bring multiple efforts together."

*-- Mike Hayes,
in praise of multiple efforts at different scales in Brazil*



Participants at the Fortaleza workshop confer on best ways to assess drought status.

Workshop in Addis Ababa looks at drought and flood prediction needs for the Greater Horn of Africa

Presentations are online from an Aug. 11-12 workshop in Ethiopia focusing on improving drought and flood forecasts in the Greater Horn of Africa. NASA, the National Drought Mitigation Center, the University of Nebraska-Lincoln, the National Meteorological Agency (NMA) of Ethiopia, the Ethiopian Meteorological Society (EtMS), and Addis Ababa University (AAU) brought together a variety of decision makers and their advisors, representing local, regional, and international organizations in the Greater Horn of Africa. Dr. Tsegaye Tadesse, NDMC climatologist, is leading the \$1.6 million NASA-funded project, "Seasonal prediction of hydro-climatic extremes in the Greater Horn of Africa under evolving climate conditions to support adaptation strategies."

The workshop had good representation from six countries, including Ethiopia, Kenya, Somalia, South Sudan, Tanzania, and South Africa. Stakeholders included decision makers and advisors from local, regional and international organizations -- private businesses, government and NGOs.



Dr. Tsegaye Tadesse, NDMC climatologist, is the principal investigator on a multi-institution, NASA-funded project to help develop more reliable, more user-friendly drought and flood forecasts for the Greater Horn of Africa.

See presentations: <http://drought.unl.edu/AboutUs/CurrentResearch/DroughtandFloodinGreaterHornofAfrica.aspx>



Dr. Masinde Muthoni, head of the Department of Information Technology, Central University of Technology, Bloemfontein, South Africa, presenting on integrating modern and indigenous drought forecasting approaches.

At right, Dr. Gui Baigorria chaired a session on continuation of existing knowledge and past experiences while looking ahead at research and applications on improved climate information.



NDMC welcomes Haileselassie G. Weldemariam

The National Drought Mitigation Center welcomes visiting scientist Haileselassie G. Weldemariam, a Ph.D. candidate from Addis Ababa University-Ethiopia. His research on the effects of climate change on water resources in the Blue Nile Basin is particularly timely, given ongoing construction of the Grand Ethiopian Renaissance Dam.



Haileselassie G. Weldemariam

I am doing my Ph.D. research on "Coupling Downscaled GCM Simulations and Hydrological Models to Determine Impacts of Climate Change and Variability on the Surface Water Resource Potential of Blue Nile Basin-Ethiopia." The primary objective of my research is to determine the spatial and temporal variability and sensitivity of surface water

resources over the central highlands of Ethiopia (Blue Nile Basin) using the latest version of the Weather Research and Forecasting (WRF) regional climate model, WRFV3.6.1 and WRF-hydro. We are working on high-resolution dynamical

downscaling (36 km, 12 km and 4 km) to come up with plausible near-term and long-term impacts of climate change and variability on the surface water potential of the basin using the ERA-Interim reanalysis and CCSM4.

The NDMC gave me this three-month opportunity to conduct my research under the supervision of Tsegaye Tadesse, Bob Oglesby, Clinton Rowe and Cynthia Hays, and to run the WRF model in the Holland Computing Center (HCC) at the University of Nebraska-Lincoln. I believe that my stay here at the NDMC/UNL will enable me to meet my research objectives because of the well-known expertise and high computational capability.

NDMC and partners to focus on drought planning for the Southern Plains

The National Drought Mitigation Center is working with partners in the southern Great Plains to adapt its Managing Drought Risk on the Ranch guidance (<http://drought.unl.edu/ranchplan>) for extended drought, such as Oklahoma and northern Texas have experienced during the past several years.

The partnership with the Southern Climate Impacts Planning Program at the University of Oklahoma, the Southern Plains Regional Climate Hub at the USDA ARS Grazinglands Research Lab, and a coalition of partners comprising the USDA-supported Grazing Coordinated Agricultural Project (<http://www.greatplainsgrazing.org/>) is funded by the USDA's Risk Management Agency.

NDMC researchers Tonya Haigh and Cody Knutson will work with the partners to modify our ranch planning materials to

incorporate adaptation to long-term, extended drought. Three workshops in the area will bring in expert speakers and help with business planning, including how to use the RMA's Pasture, Rangeland and Forage Insurance.

The project officially began Oct. 1, 2014, and will be completed in a year.

At right, technician Dan Persons herds cows and calves between pastures at the Southern Plains Experimental Range outside Fort Supply, Oklahoma. Archival photo by Stephen Ausmus, courtesy of U.S. Department of Agriculture



Wind River Reservation tribes begin drought monitoring and planning



Al C'Bearing, with the Office of the Tribal Water Engineer, opened the workshop.

A consortium of partners is providing technical support to the Eastern Shoshone and Northern Arapaho tribes on the Wind River Reservation in Wyoming as they establish reservation-wide drought monitoring and planning. Initial work has included drought monitoring and planning workshops at the University of Nebraska-Lincoln (UNL) and on the Wind River Reservation with support from the National Integrated Drought Information System (NIDIS) Program Office.

Shannon McNeeley, Colorado State University and North Central Climate Science Center, and Gary Collins, Wind River Reservation, are helping lead the coordination of this ongoing effort to assist the tribes as they develop a drought monitoring system and drought plan that addresses all 15 beneficial uses of water identified in the Wind River Water Code. This work is in close collaboration with the Office of the Tribal Water Engineer and the Wind River Water Resources Control Board. Other partner

organizations include the National Drought Mitigation Center (NDMC), the High Plains Regional Climate Center (HPRCC), NIDIS Program Office, University of Wyoming's EPSCoR program, the University of Wyoming Water Resources Data System (WRDS) and State Climate Office, the USDA Northern Plains Climate Hub, and the University of Colorado Boulder-NOAA Western Water Assessment, and other local tribal partners, water user groups, and state and federal agencies.

At the UNL workshop, July 28-29, the NDMC hosted Al C'Bearing and Jim Pogue from the tribes' Office of the Tribal Water Engineer and McNeeley. The NDMC's Mark Svoboda, Cody Knutson, and Kelly Helm Smith presented information on drought monitoring and planning. In addition, Martha Shulski, Natalie Umphlett and Crystal Stiles from the High Plains Regional Climate Center presented information on how to develop a localized drought summary.

Following up on this workshop, the NDMC's Brian Fuchs, climatologist, and Nicole Wall, public participation specialist, helped organize and participated in a workshop Oct. 21-22 at Fort Washakie on the Wind River Reservation. Fuchs presented information on how local and tribal weather observations can be incorporated into the U.S. Drought Monitor process, and Wall helped coordinate the program and logistics. Stiles and Umphlett also attended to help the tribes develop a regular summary of climate conditions for use in decision making, an important step in establishing a monitoring and early warning system.

Workshop sessions and discussion focused on local drought impacts and needs for

natural resource management and decision making during drought, the availability of drought and water monitoring data, and on how the tribes could supplement state and federal monitoring programs. Strategies included enlisting volunteer observers on the reservation for the Community Collaborative Rain, Hail and Snow network and installing and managing weather stations and stream gauges.

Participants said that having good climate data would help the tribes better manage the area's water for all of the 15 beneficial uses during times of shortage. "I think starting with accurate measurements is a must," a participant said. "If they can't say how much water is entering and exiting the system, then how can proper decisions be made? We need to do this for ourselves. If we keep on relying on others, we are doing ourselves a disservice."

A follow-up workshop is being planned for early spring of 2015 to finalize the summary and to do training on drought planning.

Follow these and related efforts on Twitter: #natedrought



Mitch Cottenor, Wind River tribal water engineer, spoke during the workshop.

Inter Tribal Buffalo Council begins planning for drought

A Sept. 16 workshop for representatives of the Inter Tribal Buffalo Council in Rapid City, South Dakota, helped start a dialog on how tribes can manage lands for buffalo during drought, said Lisa Colombe, ITBC technical service provider.

A Conservation Innovation Grant from the Natural Resources Conservation Service will help 58 tribes managing more than 1 million acres in 19 states, with a collective herd of more than 15,000 buffalo, share knowledge with each other on coping with drought. The workshop had technical support from the National Integrated Drought Information System, the National Drought Mitigation Center (NDMC), the North Central Climate Science Center at Colorado State University, and the USDA Agricultural Research Service. As part of the workshop, Cody Knutson and Mark Svoboda from the NDMC gave presentations on drought planning and monitoring, respectively. Justin Derner, USDA ARS, leading the Northern Plains Regional Climate Hub, also provided information on strategies for drought preparedness and response.



Colombe reported that attendees were pleased with the workshop, from a nice venue at the Journey Museum to a format that allowed participants to share their experiences, in addition to listening to presentations. “We kept it interactive, and just handed them the microphone for their input,” Colombe said. Participants shared information on how traditional knowledge could help them anticipate impacts of climate change.

“I’ve been trying to design everything so that when they walk away, they don’t feel like they’ve been at a workshop all day,” Colombe said. “They’re actually going home with some next steps.”

Now, she said, tribal representatives are inventorying data resources, and considering, “Should we put up little weather stations? Or are there existing ones?” They are also looking for ways to spot trends early and

develop early warning forecasts.

About 30 representatives from 14 different ITBC tribes attended the workshop. “We got people surveyed,” Colombe said. “Now we’re looking within each region for responses.” The survey asked people about their drought-related experiences, greatest concerns, management practices, goals, information needs, and more.

Four regional workshops next year will help tribes learn more about drought and preparedness and develop a collection of best practices. The grant will also provide some funds for tribes to apply best practices.

The Inter Tribal Buffalo Council was formed in 1990 to help tribes work together to return buffalo to Indian country. The organization’s web site says, “To reestablish healthy buffalo populations on tribal lands is to reestablish hope for Indian people.”

To learn more about the Inter Tribal Buffalo Council and its mission, please visit its website: <http://itbcbuffalo.com/> or Facebook page. For more information, please contact Lisa Colombe or Troy Heinert at ITBC 605-394-9730, lisa@itbcbison.com or troy@itbcbison.com.



A buffalo at Theodore Roosevelt National Park was one of 10 that were delivered to the Cherokee Nation in Oklahoma in October. The ITBC helps tribes receive surplus animals from national parks each year.



Workshop participants discussed their experience with drought and managing tribal lands for buffalo. Photos courtesy of Lisa Colombe, Inter Tribal Buffalo Council.

SDSU-led project helps South Dakota ranchers with drought

Ranchers in South Dakota learned about managing for drought and whether insurance would help, during four workshops across the state earlier this year.

Led by Laura Edwards, South Dakota State University climate field specialist, the workshops were funded by the North Central Risk Management Education Center, part of the National Institute of Food and Agriculture, and supplemented by the National Integrated Drought Information System and Farm Credit Services.

The workshops were partly based on the *Managing Drought Risk on the Ranch* planning guide (<http://drought.unl.edu/ranchplan>) developed by the National Drought Mitigation Center in cooperation with grazing and management experts across the Great Plains.

Workshops in Winner, Miller, Lemmon and Rapid City included presentations from:

- Cody Knutson, head of the NDMC's Social Science and Planning program area, who

spearheaded development of the guide, on why ranchers need written drought plans, and how to go about writing one.

- Edwards, on weather and climate monitoring.

- Pete Bauman, SDSU Extension range field specialist, on measuring grassland productivity.

- Matt Diersen, SDSU risk/business management specialist, on using Pasture, Rangeland, Forage Rainfall Index Insurance

- Stan Boltz, state rangeland management specialist, Natural Resources Conservation Service, on soil management.

- Roger Gates, range specialist, and Dave Ollila, sheep field specialist, SDSU Extension, on best rangeland management practices.

Participants received rain gauges, grazing sticks and soil infiltration kits, as well as copies of the *Managing Drought Risk on the Ranch* guide.

If you were unable to attend

"Today's workshop was excellent. ... After 2012, my biggest concern with regards to the business of ranching is the drought risk. The forage insurance may well help mediate some of the financial risk; after having spent time on the site to see what costs and benefits would be, I will be contacting an insurance agent tomorrow. ... I am especially interested in trying to increase the percentage of pasture legumes and warm season grasses. We have directed our grazing program towards improving the soil and the water cycle in the hopes of making our effective rainfall very close to the actual rainfall."

-- from a workshop participant

a workshop and are interested in the information that was shared, please contact Laura Edwards, laura.edwards@sdstate.edu, 605-626-2870. You can also contact the NDMC for materials or questions related to drought planning on the ranch (ndmc@unl.edu).



Left, Pete Bauman, SDSU Extension range field specialist from Watertown, discussed different types of grasses and their drought-hardiness. Top left, Stan Boltz, state rangeland management specialist, Natural Resources Conservation Service, gave a demonstration of the differences in water-holding capability resulting from different soil management practices. Above, Cody Knutson, front, and others at the Rapid City workshop watched a demonstration.